**Name:** _____

## Chemistry 129.03    Spring 2017

## General Chemistry

First Examination:

Equations, constants and periodic table are provided.

You may use a calculator.

# Show all your work!

page 1: _____/20

page 2: _____/15

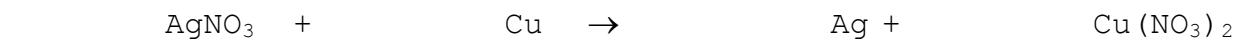page 3: _____/20

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Bonus: _____/2

Total: _____/100

1. (20%) Consider the reaction of $AgNO_3$ with Cu to produce Ag and $Cu(NO_3)_2$:

   a) How many grams of $AgNO_3$ are needed to make 20.0mL of a 0.100M $AgNO_3$ solution?

   b) Balance the chemical equation for this reaction. What type of reaction is this?

   _____ $AgNO_3$  +  _____ Cu  →  _____ Ag +  _____ $Cu(NO_3)_2$

   c) How many moles of Ag are produced when 20.0mL of a 0.100M $AgNO_3$ solution react with 0.1045g of Cu?  Identify the limiting reagent.

   d) Calculate the theoretical yield in **grams**.  If 0.1234 g of Ag are collected, what is the percent yield of the reaction?

2. (15%) Equilin contains C, H, and O.  A 13.42g sample is burned and the following data are obtained:  39.61g $CO_2$ and 9.01g $H_2O$.  Its molar mass is 268.34g/mol.  Determine the empirical and molecular formulas of Equilin.

3. (10%)  A hydrogen atom undergoes an electron transition from **n=5 to n=3**.  (a) Does this transition correspond to absorption or emission of energy?  (b) Determine the wavelength of light associated with this transition. (c) Identify the region of the electromagnetic spectrum to which it belongs.

4.  (10%) Fill in the gaps in the following table.

| Name | Formula |
|---|---|
| cobalt (II) chlorate | |
| | $XeF_4$ |
| ammonium acetate | |
| | $KMnO_4$ |
| dinitrogen tetroxide | |
| | $Cr_2(SO_3)_3$ |
| calcium bromide | |
| | $HClO$ |
| sodium hydrogen carbonate | |
| | $SO_2$ |

5. (20%) i. Draw the following orbitals (shape and orientation): $dxy$, $p_z$ and s orbitals.  How many nodal planes does each orbital have?

ii. What is the maximum number of electrons that can have of the following quantum numbers?

      $n = 4$, $m_s = +\frac{1}{2}$           _____

      $n = 3$, $l = 2$                _____

iii. Which of the following sets of quantum numbers is <u>allowed</u>?  <u>Not allowed</u>?

      $n = 1$, $l = 0$, $m_l = 0$       _____

      $n = 3$, $l = -1$, $m_l = 1$    _____

iv.  Write the **full** and **condensed** electron configurations for **Fe**.

6. (17%) Using the periodic table as a reference:

   i. Which group in the periodic table has elements with high ionization energies and very negative electron affinities? What is the charge on the ions that these atoms form? Explain.

   ii. Arrange the following in order of **increasing** atomic radius: Ne, $F^-$, Ga, $Cs^+$, F, Cs.

   iii. Draw the **atomic orbital energy diagram** of **oxygen** and show the number of valence electrons, core electrons and unpaired electrons. **Briefly** explain why the first ionization energy of oxygen is slightly lower than nitrogen's.

7. (8%) Fill in the gaps in the following table.

| Symbol | $^{24}_{12}Mg^{2+}$ | |
|---|---|---|
| Protons | | |
| Neutrons | | 32 |
| Electrons | | |
| Mass Number | | 59 |
| Charge | | 2+ |

Bonus (2pts):

Five of the boxes of following periodic table are numbered. Predict the charge on the ion associated with each of these elements.